

REMARKS/ARGUMENTS

Claims 52, 56-57 and 59-60 are amended by this response. Claim 53-55 are canceled. Claims 66-72 are added. Accordingly, claims 52 and 54-72 remain pending after entry of this response.

As an initial matter, in the latest office action the Examiner objected to claims 56-57 and 59-60. Accordingly, these claims have now been amended in the manner suggested by the Examiner in order to overcome these claim objections.

Embodiments in accordance with the present invention relate to methods of forming multilayered substrates. In accordance with particular embodiments, multilayered substrates may be formed by a controlled cleaving process to separate a film of material from a donor substrate. In such embodiments, a cleave front is initiated at a first energy, and then this cleave front is propagated by subsequent application of a lower energy:

a cleave is initiated by subjecting the material with sufficient energy to fracture the material in one region, causing a cleave front, without uncontrolled shattering or cracking. The cleave front formation energy (E_c) must often be made lower than the bulk material fracture energy (E_{mat}) at each region to avoid shattering or cracking the material. The directional energy impulse vector in diamond cutting or the scribe line in glass cutting are, for example, the means in which the cleave energy is reduced to allow the controlled creation and propagation of a cleave front. (Emphasis added; page 3, lines 20-27)

An express goal of the controlled cleaving processes in accordance with the instant application, is thus to avoid the damage to substrates associated with conventional, uncontrolled cleaving:

the present invention limits energy or stress in the substrate to a value below a cleave initiation energy, which generally removes a possibility of creating random cleave initiation sites or fronts. This reduces cleave damage (e.g., pits, crystalline defects, breakage, cracks, steps, voids, excessive roughness) often caused in pre-existing techniques. (Emphasis added; page 4, lines 21-26)

Accordingly, pending independent claim 52 recites as follows:

52. A method for forming multilayered substrates, the method comprising:

... releasing the film of material from the donor substrate, while maintaining attachment to the transfer substrate, the releasing comprising,

providing a first energy to a selected region of the donor substrate to initiate a controlled cleaving action, and
providing a second energy lower than the first energy to sustain the controlled cleaving action in order to free the overlying film from the donor substrate; and
coupling the film of material on the transfer substrate to a handle substrate;
transferring the film of material from the transfer substrate to the handle substrate to free the film of material from the transfer substrate while providing the film of material on the handle substrate.

The Examiner has rejected the pending claims, either as anticipated under 35 U.S.C. §102 or obvious under 35 U.S.C. §103, based upon U.S. Pat. No. 5,993,677 to Biasse et al. ("the Biasse patent"). These claim rejections are overcome as follows.

As a threshold matter, the Examiner is reminded that for anticipation under 35 U.S.C. §102, the reference relied upon by the Examiner must teach every aspect of the claimed invention, either explicitly or impliedly. Any feature not directly taught must be inherently present. (Emphasis added; MPEP 706.02) Moreover, in order to establish a prima facie case of obviousness, "the prior art reference (or references when combined) must teach or suggest all the claim limitations." MPEP 2143. Here, the Biasse patent, considered separately or in combination with other references, fails to teach or suggest the elements of the pending claims.

The Biasse patent does describe formation of a multilayered substrate. However, this reference fails to teach or even suggest, a method wherein a cleave front is initiated at a first energy and then propagated at a lower energy, in the manner of the claimed embodiments. Specifically, in the Biasse patent, a donor substrate (referenced as the "initial" substrate) is removed from a transfer substrate (referenced as the "handle" substrate), as follows:

When the joining of the handle substrate with the thin film is carried out with a liaison energy which is greater than the liaison energy between the thin film and the initial substrate, the initial substrate may be detached by tearing.

For this purpose, opposite tensile forces are exerted on the initial substrate and the handle substrate, which said forces are capable of causing a tearing of the initial substrate along the first face of the thin film. (Emphasis added; col. 4, lines 7-14)

This passage represents the extent of detailed discussion in the Biasse patent regarding separating an initial (donor) substrate from a handle (transfer) substrate. There is no teaching or

even suggestion here, to utilize a controlled cleaving process in the manner taught by the instant application. Rather, repeated reference in the Biasse patent to separation by "tearing", indicates an uncontrolled process characteristic of the prior art. As emphasized at length in the instant application, such a conventional uncontrolled substrate separation process would result in surfaces exhibiting defects and roughness avoided by controlled cleaving in accordance with the claimed embodiments. There is no teaching in the Biasse patent, explicit or even implied, regarding separating a donor wafer from a transfer wafer utilizing controlled cleaving.

In order to reject certain of the pending claims as obvious, the Examiner has combined the Biasse patent with Japanese Patent Publication No. 07-164728 to Takemura et al. ("the Takemura publication"). Inclusion of this reference, however, does nothing to provide any teaching regarding the controlled cleaving process recited in the pending claims.

Specifically, the English language abstract of the Takemura publication contains only a cursory mention of "releasing" a substrate sheet. There is no teaching or even suggestion regarding separating donor and transfer substrates by controlled cleaving in the manner of the claimed embodiments.

Based upon the failure of the art relied upon by the Examiner to teach or suggest every element of the pending claims, it is respectfully asserted that continued maintenance of the pending claim rejections is improper, and these claim rejections should be withdrawn.

Finally, new claims 66-72 have been added. Claims 66 and 68 recite providing energy from at least one of a chemical source, a mechanical source, an electrical source, and a thermal source. Support for this claim may be found in the instant specification as originally filed, at least at page 10, lines 5-6.

Claims 67 and 69 recite application of energy at least as one of flood, time-varying, spatially varying, and continuous. Support for this claim may be found in the instant specification as originally filed, at least at page 10, line 14.

Claim 70 recites that the donor substrate comprises a region between the overlying film of material to be detached and a portion of the donor substrate. Support for this claim may be found in the instant specification as originally filed, at least at page 12, line 15.

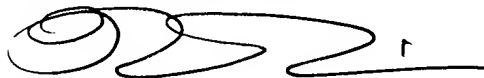
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Claim 71 recites that the donor substrate comprises a plurality of hydrogen particles between the overlying the film of material to be detached and a portion of the donor substrate. Support for this claim may be found in the instant specification as originally filed, at least at page 6, lines 29-31.

Claim 72 recites that the donor substrate comprises silicon material. Support for this claim may be found in the instant specification as originally filed, at least at page 6, lines 1-5.

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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